CLAIMS

What is claimed is:

1	1. An apparatus for measuring retardance in a sample, comprising:				
2	a sample chamber for receiving the sample;				
3	an illuminator for providing an illumination light;				
4	optics for directing the illumination light toward the sample;				
5	a detector for measuring an intensity of light incident on the detector;				
6	optics for directing light that has interacted with the sample toward the detector;				
7	a first polarizer for selectively transmitting light that is substantially circularly polarized				
8.	a second polarizer for selectively transmitting light that has a selected elliptical				
9	polarization state;				
10	a controller for varying a selected elliptical polarization state of the second polarizer to				
11	correspond to a plural number of states χ_i with a chosen Poincare latitude and longitude within a				
12	distance ε of a chosen pole of a Poincare sphere; and				
13	a processor connected to the detector for determining the sample retardance from the				
14	measured incident light intensity obtained when the second polarizer is set to each of the states				
15	wherein none of the states χ_i corresponds to circular polarization.				
1	2. The apparatus of claim 1, wherein the illumination light is transmitted by the				
2	sample.				

1		3.	The apparatus of claim 1, wherein the il	llumination light is re	flected by the
2	sample	. .		V.	e' .
1		4.	The apparatus of claim 1, wherein:		
2	,	the fir	st polarizer is located between the illumination	nator and the sample	chamber; and
3		the se	cond polarizer is located between the san	ple chamber and the	detector.
1-	•	5.	The apparatus of claim 1, wherein:		#
2		the se	cond polarizer is located between the illu	minator and the samp	ole chamber; and
3		the fir	st polarizer is located between the sampl	e chamber and the de	tector.
1.		6.	The apparatus of claim 1, wherein the r	number of states χ is 2	2.
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1		7.	The apparatus of claim 1, wherein the r	number of states χ, is ?	3.
		:		·	
1	•	8.	The apparatus of claim 1, wherein the r	number of states χ _i is 4	1.
					*
1		9.	The apparatus of claim 1, wherein the s	econd polarizer comp	orises an electro-option
2 -	retardo	er elem	ent.		
		· ·		*	
1	* .	10.	The apparatus of claim 1, wherein the	second polarizer comp	orises at least one
2	fixed r	retarde	and mechanical switching means.	*	<i>y</i> :

1	11. The apparatus of claim 1, wherein the illumination light is substantially
2	monochromatic.
1	12. The apparatus of claim 1, wherein the illuminator comprises a broadband source
2	and a filter.
1	13. The apparatus of claim 1, wherein ε is 35 degrees or less.
1	14. The apparatus of claim 1, wherein ε is 20 degrees or less.
1 -	15. An apparatus for measuring retardance in a sample, comprising:
2	a sample chamber for receiving the sample;
3	a source of illumination light;
4	optics for directing the illumination light toward the sample;
5	a detector for measuring an intensity of light incident on the detector;
6	optics for directing light that has interacted with the sample toward the detector;
7	a first polarizer for selectively transmitting light that is substantially circularly polarized;
8	a second polarizer for selectively transmitting light that has one of a selected elliptical
9	polarization state and a circular polarization state:

0	a controller for varying the polarization state of the second polarizer to correspond to a			
1	plural number of states χ_i with a chosen Poincare latitude and longitude within a distance ϵ of a			
12	chosen pole of a Poincare sphere; and			
13	a processor connected to the detector for determining the sample retardance from the			
14	measured incident light intensity obtained when the second polarizer is set to each of the states			
5	χι;			
16	wherein the number of states is five, and wherein one of the states χ_i corresponds to			
17	circular polarization.			
1 .	16. The apparatus of claim 15, wherein ε is 35 degrees or less.			
. '				
1	17. The apparatus of claim 15, wherein ε is 20 degrees or less.			
1	18. A method for measuring retardance in a sample in a sample chamber, comprising			
2	the steps of:			
3	producing an illumination beam of light;			
4	directing the illumination beam toward the sample;			
5	collecting directed illumination light that has interacted with the sample to form a			
6	collected light beam;			
7	directing the collected light beam toward a photodetector;			
8	directing one of the illumination beam and the collected light beam through a circular			
a	nolarizer			

10	directing the other of the illumination beam and the collected light beam through a				
11	variable polarizer that expresses a plural number of elliptical polarization states $\chi_{i;}$				
12	measuring an intensity of light incident on the photodetector during each of the plural				
13	states χ_i ; and		g go ***		
14	calculating the retardance of the sample using the p	hotodetector lig	tht intensity		
15	measurements;		. 6		
16	wherein the number of states χ_i is four or less and n	none of the state	s χ _i is circular.		
	•	*			
1	19. The method of claim 18, wherein each of th	ne plural states χ	i lies within a distance		
. 2	ε from a chosen pole of the Poincare sphere.				
1	20. The method of claim 19, wherein ε is 35 de	grees or less.			
1	21. The method of claim 19, wherein ε is 20 de	grees or less.	* *		
			en e		
1 .	22. The method of claim 18, further comprising	g the steps of:			
2,	measuring the intensity of light incident on the pho	otodetector while	e the variable polarizer		
3	expresses a plurality of states χ_i and the sample is not present in the sample chamber; and				
4	using the measured intensities of light incident on t	the photodetecto	or when the sample is		
5	not present to improve the calculation of sample retardance	e.	7.		

1	23. The method of claim 22, wherein said measuring the intensity of light with the				
2	sample not present in the sample chamber comprises measuring the light intensity with the				
3	sample replaced by a calibration target of substantially no retardance and a calibration target of				
4	known retardance.				
1	24. A method for measuring retardance in a sample in a sample chamber, comprising				
2	the steps of:				
3	producing an illumination beam of light;				
4	directing the illumination beam toward the sample;				
5.	collecting directed illumination light that has interacted with the sample to form a				
6	collected light beam;				
7 .	directing the collected light beam toward a photodetector;				
8	directing one of the illumination beam and the collected light beam through a circular				
9	polarizer;				
10	directing the other of the illumination beam and the collected light beam through a				
1,1	variable polarizer, wherein the variable polarizer expresses a plural number of polarization states				
12	χ_i including a plural number of elliptical polarization states and a circular polarization state;				
13	measuring an intensity of light incident on the photodetector during each of the plural				
14	states χ_i ; and				
15	calculating the retardance of the sample using the photodetector light intensity				
16	measurements,				
17					

1	25.	The method of claim 24, wherein each of the plural states χ_i lies within a distance				
2	ε from a chos	en pole of the Poincare sphere.				
· ·						
1	26.	The method of claim 25, wherein ε is 35 deg	grees or less.			
•			*			
.1	27.	The method of claim 25, wherein ε is 20 deg	grees or less.		± € € € € € € € € € € € € € € € € € € €	
1	28.	The method of claim 24, further comprising	the steps of	+ 7	,	
2	meas	uring the intensity of light incident on the phot	todetector while	the variable po	larize	
3	expresses a p	expresses a plurality of states χ_i and the sample is not present in the sample chamber; and				
4	using	using the measured intensities of light incident on the photodetector when the sample is				
5	not present to	improve the calculation of sample retardance).		,	
		*				
1	29.	The method of claim 28, wherein said meass	uring the intensi	ty of light with	the	
2	sample not p	resent in the sample chamber comprises measu	uring the light in	tensity with the	;	
3	sample repla	ced by a calibration target of substantially no r	retardance and a	calibration targ	et of	
4	known retard	lance.			.·	